Continental growth, onset of plate tectonics and emergence of the continents

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The continental crust has evolved over billions of years, helping to create the environment we live in and the resources we depend on. Less than 5% of the geological record consists of juvenile rocks older than 3 Ga and there are no known rocks older than 4.03 Ga. In contrast recent models of continental growth suggest that at least ~60-75% of the present volume of the continental crust had been generated by 3 Ga. Such models imply that large volumes of pre-3 Ga crust were destroyed and replaced by younger crust since the late Archaean.

Our modelling suggests that new continental crust was generated continuously, but with a marked decrease in the growth rate at ~3 Ga. Destruction rates increased markedly at ~3.0 Ga, which we ascribe to the onset of plate tectonics. Over 100% of the present volume of continental crust has been destroyed and recycled back into the mantle since that time, and during the mid/late Proterozoic the volume of continental crust may have exceed its present value.

There is increasing evidence that ~3 Ga marked the transition between two different types of continental crust. Continental crust generated before this time was on average mafic, dense and relatively thin (<20 km). In contrast, continental crust that formed after 3 Ga gradually became more intermediate in composition, buoyant and thicker. The increase in crustal thickness is accompanied by increasing rates of crustal reworking and increasing input of sediment to the ocean. These changes may have been accommodated by a change in the lithosphere strength at around 3 Ga, as the latter became strong enough to support high relief crust. This time period therefore indicates when significant volumes of continental crust started to become emergent and was available for erosion and weathering, thus impacting on the composition of the atmosphere and oceans